TSMC00-511

1. A process for removing contaminants from a surface of a semiconductor wafer, comprising:

providing a source of laser light and a lens system capable of focusing said laser light to a focal point;

obtaining positional co-ordinates, on the wafer surface, for a particle;

using said positional co-ordinates, placing the lens so that the focal point is directly in line with said particle and at a distance therefrom;

passing said laser light through the lens at a power level sufficient to form, at said focal point, an optical trap into which said particle is drawn; and

then disposing of the particle whereby it is not returned to the wafer surface.

2. The process described in claim 1 wherein the particle has a mean diameter less than about 1 micron.

3. The process described in claim 1 wherein the lens system has a numerical aperture greater than about 0.8.

4. The process described in claim 1 wherein the power level of the laser is at least about 10 W.

5. The process described in claim 1 wherein the lens system may also used for

obtaining said positional co-ordinates.

6. The process described in claim 1 wherein said surface further comprises an integrated circuit and said positional co-ordinates are such that the particle has a non-zero probability of damaging said circuit.

7. The process described in claim 1 wherein the step of disposing of the particle further comprises reducing the power level until the particle is drawn out of the trap by gravitational forces.

8. The process described in claim 1 wherein said distance between the particle and the focal point is between about 200 and 500 nanometers.

9. A process for removing contaminant particles from a downward-facing surface of a semiconductor wafer, comprising:

providing a source of laser light and a lens system capable of focusing said laser light to a focal point;

obtaining positional co-ordinates, on the wafer surface, for a set of said particles;

providing a stream of gas that flows past and around the wafer in a downward direction;

performing the sequential steps of:

(a) using said positional co-ordinates, placing the lens so that the focal point is directly below a particle of the set at a distance therefrom;

(b) passing said laser light through the lens at a power level sufficient to form, at said focal point, an optical trap into which said particle is drawn;

(c) reducing said power level whereby the particle is removed through a combination of gravitational forces and said stream of gas; and

repeating steps (a), (b), and (c) for all other member of the set of particles.

10. The process described in claim 9 wherein the particles have mean diameters less than about 1 micron.

11. The process described in claim 9 wherein the lens system has a numerical aperture greater than about 0.8.

12. The process described in claim 9 wherein the power level of the laser is at least about 10 W.

13. The process described in claim 9 wherein said distance between a particle and the focal point is between about 200 and 500 nanometers.

14. The process described in claim 9 wherein the set of particles consists of all particles on the wafer surface.

15. The process described in claim 9 wherein said surface further comprises an integrated circuit and the set of particles consists of all particles that have a non-zero probability of damaging said circuit.

16. A process for removing contaminant particles from an upward-facing surface of a semiconductor wafer, comprising:

providing a source of laser light and a lens system capable of focusing said laser light to a focal point;

obtaining positional co-ordinates, on the wafer surface, for a set of said particles;

performing the sequential steps of:

(a) using said positional co-ordinates, placing the lens so that the focal point is directly above a particle of the set at a distance therefrom;

(b) passing said laser light through the lens at a power level sufficient to form, at said focal point, an optical trap into which said particle is drawn;

(c) disposing of the particle whereby it is not returned to the wafer surface; and

repeating steps (a), (b), and (c) for all other member of the set of particles.

17. The process described in claim 16 wherein the step of disposing of the particle

further comprises moving the focal point until it is no longer above the wafer surface and then reducing said power level whereby the particle is removed by gravity.

18. The process described in claim 16 wherein the step of disposing of the particle further comprises:

increasing the distance between the focal point and the wafer surface;

inserting a catcher plate between the focal point and the surface;

reducing said power level whereby the particle falls onto the catcher plate; and

then removing the catcher plate.

19. The process described in claim 16 wherein the step of disposing of the particle further comprises moving the wafer until it is no longer beneath the focal point and then reducing said power level whereby the particle is removed by gravity.

20. The process described in claim 16 wherein the step of disposing of the particle further comprises:

providing a tube having a first end that is open and a second end that is connected to a container maintained at a pressure lower than that at the focal point; and

positioning the tube so that said open end is near the particle being held in the light trap, thereby sucking the particle out of the light trap into said low pressure container.

21. The process described in claim 16 wherein the step of disposing of the particle further comprises:

providing a tube having a first end that is open and a second end that is connected to a source of pressure that is higher than that at the focal point; and

positioning the tube so that said open end is near the particle being held in the light trap, thereby blowing the particle out of the light trap and away from the wafer.

22. The process described in claim 16 wherein the set of particles consists of all particles on the wafer surface.

23. The process described in claim 16 wherein said surface further comprises an integrated circuit and the set of particles consists of all particles that have a non-zero probability of damaging said circuit.